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Ecology and Natural History of Tropical Bees.—David W. Roubik. 1989. Cambridge University Press. x + 514 pp. \$69.50 hardcover.

Anyone with even a glimmer of interest in natural history should find it easy to appreciate the beauty and fascination of bees. To begin with, they are aesthetically appealing. One need not be an entomologist to notice the close association of bees with flowers. Most of us probably learned in elementary school, or perhaps a little later when first exposed to that venerable old analogy for sexual reproduction, that the colors, shapes, and aromas that we find so pleasing in flowers owe their origins to complex interactions that these flowers have with bees (and other pollinators). Furthermore, bees are elegant and beautiful creatures in their own right, some sporting brilliant metallic hues as gaudy as anything in the animal kingdom, others more subtly clothed in elegant plumose vestiture. As with any area of natural history, an interest first sparked by simple aesthetic delight grows deeper and more captivating as one attempts to find explanations for the bewildering diversity of bees.

Consequently, it is rather puzzling that the English-speaking world has so few books dealing in a general way with the natural history of bees other than honey bees and bumblebees (not that there is anything wrong with these two genera, but they are just the tip of the iceberg). Anyone able to read German can enjoy the products of a long tradition of lovingly detailed, beautifully illustrated treatises on the biology of all the bees of central Europe. However, in America there is one publication from the Agricultural Experiment Station of Oregon State University (Stephen et al., 1969), which you will be lucky to find in your library, and Michener's (1974) widely-cited and influential text, which deals only with social bees. So far as I know, even the English, with their unequalled passion for natural history, have been woefully remiss in producing good general books on the natural history and ecology of bees.

Perhaps the editors of the Cambridge Tropical Biology Series sensed this crying need for a book on bees. Or perhaps they were seduced not by the intrinsic appeal of bees themselves, but by the rich and complex interactions between bees and angiosperms. (Complex interactions are an irresistible magnet for tropical biologists.) Whatever the motivation for commissioning a book about the ecology of tropical bees, an obvious choice for the author was David Roubik, who has more than a decade of research experience specifically with tropical bees.

The book that Dr. Roubik has produced is ambitious and comprehensive in scope. After a short introductory chapter that crudely sketches the classification, phylogeny, and geographic distribution of bees and outlines the basic life histories of solitary and social forms, he launches into detailed discussions of foraging behavior and pollination biology, nesting behavior and reproductive biology, and community ecology. No previous author has attempted to synthesize such a broad range of topics for bees. The chapter on foraging and pollination catalogs the types of resources gathered by bees and how they are collected, follows this with theoretical and empirical discussions of foraging ecology, and concludes with a section on pollination ecology that considers the interactions between bees and flowering plants. The next chapter deals with nesting and reproductive biology. It summarizes the wide variety

of nest architectures employed by bees, along with the array of natural enemies and associates that are drawn to these nests. The final section in this chapter discusses mate selection, larval development and nutrition, modes of reproduction in solitary and social bees, and some general aspects of population genetics in bees. The book's final chapter covers several topics in community ecology, including bee seasonality, abundance, and flower preference, ecological (as opposed to historical) biogeography of bees, and the roles of bees in communities.

A major challenge for any author trying to write about a group of organisms as diverse as bees is that he or she cannot possibly avoid discussing many organisms that will be unfamiliar to most of his or her readers. Illustrations are the traditional method for dealing with this problem, and carefully selected illustrations can be extremely effective. In addition to the many graphs and tables that are such an essential (and rarely appreciated) feature of communication among scientists, Roubik's book is filled with numerous excellent drawings and photographs that should help any reader visualize bees as living organisms. The book also contains a unique appendix of black-and-white photographs of museum specimens of tropical bees, which provides a direct visual impression of bee diversity.

Ideally, a general book such as this, which summarizes and synthesizes such a wide range of information, would also be written in a lucid and engaging style that would capture the interest and excite the imagination of any ecologist or evolutionary biologist who picks it up. I found the book to be a disappointment in this respect. I was repeatedly frustrated when the author was discussing an intriguing topic in evolutionary biology, but I lost track of the logic of his argument in a dense thicket of misplaced modifiers within sentences, unrelated sentences within paragraphs, and paragraphs with no obvious relevance to the chapter heading under which they were placed. Perhaps a more patient or persistent reader will not find this as troublesome as I did, and perhaps he or she will discover important new ideas and insights about evolutionary biology where I did not. In any case, Roubik's book is a valuable and unique compendium of information about bees in general, and tropical bees in particular.—*Byron Alexander, Snow Entomological Museum, Snow Hall, University of Kansas, Lawrence, Kansas 66045.*

LITERATURE CITED

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